TETRA TECH

PHIL-25957

February 6, 2015

Project Number 04635

Mr. Brad White (3HS22)
U.S. Environmental Protection Agency (EPA) Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Reference: Remedial Action Contract - EPA Region 3
EPA Contract Number EP-S3-07-04

Subject: Summary of Round 3 ISCO Injections
Valmont TCE Site
Long-Term Remedial Action (LTRA)
EPA Work Assignment No. 052-RALR-031M

Dear Mr. White:

This letter summarizes the Round 3 in-situ chemical oxidation (ISCO) injections conducted at the subject site between November 17, 2014 and December 9, 2014 (Enclosure). As part of this work, Tetra Tech injected approximately 9,131 gallons of 10% sodium permanganate into 19 total zones at the site.

Please contact me if you have any questions or comments.

Sincerely,

Neil Teamerson

Neil Teamerson
Project Manager

NT/pg

Enclosure

c: Vince Shickora (Tetra Tech)
File No. 3

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ENCLOSURE

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SUMMARY OF ROUND 3 ISCO INJECTION PROGRAM
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

1.0 INTRODUCTION

This enclosure provides information regarding the Round 3 in-situ chemical oxidation (ISCO) injections conducted at the subject site between November 17, 2014 and December 9, 2014. The first tanker truck delivered approximately 4,600 gallons of a 10% blended sodium permanganate (NaMnO4) solution (hereafter referred to as perm) to the site at 2:45 p.m. on November 14, 2014. Tetra Tech transferred the perm to the 5,000-gallon Baker tank at the rear of the site building near well E-2.

Injection activities are described below on a well-by-well and zone-by-zone basis. Lower zones were deeper in depth compared to upper (or shallower) zones. The attachment to this enclosure provides graphical representations of the pressure transducer measurements obtained during injections.

2.0 WELL E-14

2.1 Well E-14 (Lower Zone - 55' to 100' Interval)

- 550 gallons of perm injected to this interval on November 18, 2014.
- Average pressure during injection was 52.5 psi.
- Average flow rate during injection was 4.6 gpm.
- Total time for perm injection was 119 minutes.
- Approximately 30 gallons of potable water were flushed/injected to well following perm injection.

Subcontractor's perm transfer tank was 550-gallon poly. Due to the time necessary to refill poly transfer tank with additional volume required to complete the E-14 injection, and freezing conditions at the outdoor 5,000-gallon tank, the remaining 50 gallons required for this interval was not injected. This decision was discussed with EPA.

2.2 Well E-14 (Upper Zone - 20' to 55' Interval)

- Total perm injected to interval was 600 gallons on November 19, 2014 according to plan.
- Average pressure during injection was 51 psi.
- Average flow rate during injection was 6.5 gpm.
- Total time for perm injection was 92 minutes.
- Approximately 35 gallons of potable water were flushed/injected to well following perm injection.

Due to mechanical problems with the Subcontractor's Geoprobe rig, which caused an 80-minute delay following this injection, additional injections were not conducted on this date.

2.3 Well E-14 Injection Event (Water Level Measurements)

A. Lower Zone (55-100 ft.) Injection: Injection Rate 4.6 gpm @ 52.5-psi well pressure.

Significant hydraulic connection: E-14 to E-2 with 6.45 ft. water level increase at E-2; E-14 to MW-31D with 6.02 ft. water level increase at MW-31D.

Good Hydraulic Connection: E-14 to MW-11S with 2.65 ft. water level increase at MW-11S; E-14 to MW-11D with 1.52 ft. water level increase at MW-11D.

Limited hydraulic connection: E-14 to MW-28S with 0.82 ft. water level increase at MW-28S; E-14 to MW-31S with 0.54 ft. water level increase at MW-31S.

B. Upper Zone (20-55 ft.) Injection: Injection Rate 6.5 gpm @ 51 psi well pressure.

Significant hydraulic connection: E-14 to E-2 with 5.5 ft. water level increase at E-2; E-14 to MW-31D with 4.13 ft. water level increase at MW-31D.

Good Hydraulic Connection: E-14 to MW-11S with 2.08 ft. water level increase at MW-11S.

Limited hydraulic connection: E-14 to MW-11D with 0.87 ft. water level increase at MW-11D; E-14 to MW-28S with 0.39 ft water level increase at MW-28S; and E-14 to MW-31S with 0.61 ft. water level increase at MW-31S.

3.0 WELL E-12

3.1 Well E-12 (Lower Zone - 56' to 100' Interval)

- Total perm injected to interval was 650 gallons on November 20, 2014, according to plan.
- Average pressure during injection was approximately 90 psi.
- Average flow rate during injection was 2.6 gpm.
- Total time for perm injection was 249 minutes.
- Approximately 20 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were noted during this injection.

3.2 Well E-12 (Upper Zone - 20' to 56' Interval)

- Total perm injected to interval was 650 gallons on November 20 and 21, 2014 according to plan.
- Average pressure during injection was approximately 20 psi.
- Average flow rate during injection was 7.4 gpm.
- Total time for perm injection was 87 minutes.
- Approximately 25 gallons of potable water were flushed/injected to well following perm injection.

During injection activities on November 20, 2014, the upper packer blew out after 13 minutes of injection time. The cause of this blowout may have been related to the Subcontractor inadvertently installing 6-inch diameter packers in this well for injections. Well E-12 is an 8-inch diameter well. Subcontractor personnel indicated that the 6-inch packers should be capable of sealing an 8-inch diameter well and the problem could have been caused by a dimple on the packer noticed during installation activities. The subcontractor supervisor did not think that this dimple was cause for concern at the time and packers were installed. The blowout occurred at the point where the dimple was observed.

3.3 E-12 Injection Event (Water Level Measurements)

A. Lower Zone (56-100 ft.) Injection: Injection Rate 2.6 gpm @ 90-psi well pressure.

Significant Hydraulic Connection: E-12 to E-11 with 3.18 ft. water level increase at E-11.

Good Hydraulic Connection: E-12 to E-13 with 1.75 ft. water level increase at E-13.

Limited Hydraulic Connection: E-12 to E-4 with 0.52 ft. water level increase at E-4; E-12 to MW-31S with 0.60 ft. water level increase at MW-31S; E-12 to MW-31I with 0.36 ft. water level increase at MW-31I; and E-12 to MW-28S with 0.91 ft. water level increase at MW-28S.

B. Upper Zone (20-56 ft.) Injection: Injection Rate 7.4 gpm @ 20-psi well pressure.

Significant Hydraulic Connection: E-12 to E-13 with 2.36 ft. water level increase at E-13.

Good Hydraulic Connection: E-12 to E-11 with 1.21 ft. water level increase at E-11.

Limited or no Hydraulic Connection: E-12 to E-4 with 0.09 ft. water level increase at E-4; E-12 to MW-31S with 0.42 ft. water level increase at MW-31S; E-12 to MW-31I with 0.29 ft. water level increase at MW-31I; and E-12 to MW-28S with 0.39 ft. water level increase at MW-28S.

4.0 WELL E-10

4.1 Well E-10 (Lower Zone - 70' to 100' Interval)

- Total perm injected to interval was 365 gallons on November 24, 2014.
- Average pressure during injection was 100 psi.
- Average flow rate during injection was 1.5 gpm.
- Total time for perm injection was 240 minutes.
- Approximately 20 gallons of potable water were flushed/injected to well following perm injection.

Due to limited flow to this zone (1.5 gpm) and decision-making guidelines of the Round 3 Injection Work Plan (i.e., 4-hour time limit on low flow injections), the total volume injected to this zone was 85 gallons less than proposed. Remaining 85 gallons were injected into upper zone of E-10 (see below).

4.2 Well E-10 (Upper Zone - 20' to 50' Interval)

- Total perm injected to interval zone was 535 gallons on November 24, 2014.
- Average pressure during injection was 40 psi.
- Average flow rate during injection was 7.9 gpm.
- Total time for perm injection was 67 minutes.
- Approximately 25 gallons of potable water flushed/injected to well following perm injection.

No problems or issues were recorded during this injection.

4.3 E-10 Injection Event (Water Level Measurements)

A. Lower Zone (70-100 ft.) Injection: Injection Rate 1.5 gpm @ 100-psi well pressure.

Significant Hydraulic Connection: E-10 to E-11 with 3.38 ft. water level increase at E-11; E-10 to E-9 with 3.08 ft. water level increase at E-9.

Some Hydraulic Connection: E-10 to E-3 with 0.76 ft. water level increase at E-3. Lag time was observed.

Limited Hydraulic Connection: E-10 to E-13 with 0.62 ft. water level increase at E-13; E-10 to MW-31I with 0.58 ft. water level increase at MW-31I; E-10 to E-6 with 0.19 ft. water level increase at E-6.

No Hydraulic Connection between E-10 and MW-18S.

B. Upper Zone (20-50 ft.) Injection: Injection Rate 7.9 gpm @ 40-psi well pressure.

Significant Hydraulic Connection: E-10 to E-11 with 1.09 ft. water level increase at E-11; E-10 to E-9 with 2.66 ft. water level increase at E-9.

Some Hydraulic Connection: E-10 to E-6 with 0.46 ft. water level increase at E-6.

C. Limited or No Hydraulic Connection: E-10 to E-13 with 0.27 ft. water level increase at E-13; E-10 to MW-31I with 0.30 ft. water level increase at MW-31I; E-10 to MW-18S with 0.06 ft. water level increase at MW-18S; and E-10 to E-3 with 0.05 ft. water level increase at E-3.

5.0 WELL E-13

5.1 Well E-13 (Lower Zone - 46' to 76' Interval)

- Total perm injected to interval was 750 gallons on November 25, 2014.
- Average pressure during injection was 5 psi.
- Average flow rate during injection was 7.1 gpm.
- Total time for perm injection was 105 minutes.
- 25 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were reported during this injection.

5.2 Well E-13 (Upper Zone - 20' to 50' Interval)

- Total perm injected to interval was 750 gallons on November 25 and December 1, 2014.
- Average pressure during injection was 10 psi.
- Average flow rate during injection was 10.4 gpm.
- Total time for perm injection was 72 minutes.
- Approximately 25 gallons of potable water were flushed/injected to well following perm injection on each day of activities.

No problems or issues were observed during this injection. Second tanker delivery of approximately 4,600 gallons was received on December 1, 2014. Perm was transferred to on-site 5,000-gallon Baker tank at rear of site building near well E-2.

5.3 E-13 Injection Event (Water Level Measurements)

A. Lower Zone (46-76 ft.) Injection: Injection Rate 7.1 gpm @ 5-psi well pressure.

Significant Hydraulic Connection: E-13 to MW-28S with 5.79 ft. water level increase at MW-28S; E-13 to MW-28I with 5.43 ft. water level increase at MW-28I (lag time was observed); E-13 to E-12 with 2.55 ft. water level increase at E-12; and E-13 to MW-31I with 2.63 ft. water level increase at MW-31I.

Limited Hydraulic Connection: E-13 to E-4 with 0.56 ft. water level increase at E-4; E-13 to E-31S with 0.42 ft. water level increase at MW-31S (about 30 minutes lag time, no direct connection).

B. Upper Zone (20-50 ft.) Injection: Injection Rate 10.4 gpm @ 10-psi well pressure.

Significant Hydraulic Connection: E-13 to E-12 with 3.19 ft. water level increase at E-12.

Some Hydraulic Connection: E-13 to MW-28S with 0.70 ft. water level increase at MW-28S; E-13 to MW-31S with 0.78 ft. water level increase at MW-31S; E-13 to MW-31I with 0.57 ft. water level increase at MW-31I.

Limited Hydraulic Connection: E-13 to E-4 with 0.20 ft. water level increase at E-4 (about 30 minutes lag time, indirect hydraulic connection); and E-13 to MW-28I.

6.0 WELL E-11

6.1 Well E-11 (Lower Zone - 70’ to 100’ Interval)

- Total perm injected to interval was 1,000 gallons on December 2, 2014.
- Average pressure during injection was 15 psi.
- Average flow rate during injection was 7.35 gpm.
- Total time for perm injection was 136 minutes.
- 25 gallons of potable water were flushed/injected to well following perm injection.

The Subcontractor used 250-gallon perm transfer tank at this location due to larger 550-gallon tank breaking pallets when full. This caused length of injection to increase due to time needed to refill 250-gallon tank several times. No other problems or issues were noted.

6.2 Well E-11 (Upper Zone - 20' to 70' Interval)

- Total perm injected to zone was 1,000 gallons on December 2 and 3, 2014.
- Average pressure during injection was 10 psi.
- Average flow rate during injection was 6.9 gpm.
- Total time for perm injection was 143 minutes.
- 25 gallons of potable water were flushed/injected to well following perm injection.

The Subcontractor used 250-gallon perm transfer tank at this location due to larger 550-gallon tank breaking pallets when full. This caused length of injection to increase due to time needed to refill 250-gallon tank several times. No other problems or issues were noted.

6.3 E-11 Injection Event (Water Level Measurements)

A. Lower Zone (70-100 ft.) Injection: Injection Rate 7.35 gpm @ 15-psi well pressure.

Significant Hydraulic Connection: E-11 to E-10 with 3.74 ft. water level increase at E-10; and E-11 to E-4 with 2.27 ft. water level increase at E-4.

Good Hydraulic Connection: E-11 to E-9 with 1.23 ft. water level increase at E-9; and E-11 to E-12 with 1.10 ft. water level increase at E-12.

Limited or No Hydraulic Connection: E-11 to E-6 with 0.36 ft. water level increase at E-6 (about 30 minutes lag time, no direct hydraulic connection); and E-11 to MW-18S.

B. Upper Zone (20-70 ft.) Injection: Injection Rate 6.9 gpm @ 10-psi well pressure.

Significant Hydraulic Connection: E-11 to E-10 with 3.32 ft. water level increase at E-10.

Good Hydraulic Connection: E-11 to E-9 with 1.88 ft. water level increase at E-9; E-11 to E-4 with 1.24 ft. water level increase at E-4; E-11 to E-12 with 0.91 ft. water level increase at E-12.

Limited Hydraulic Connection: E-11 to E-6 with 0.20 ft. water level increase at E-6 (lag time was noted).

7.0 WELL E-9

7.1 Well E-9 (30' to 40' Interval)

- Total perm injected to interval was approximately 136 gallons on December 3, 2014.
- Average pressure during injection was 25 psi.
- Average flow rate during injection was 8.0 gpm.
- Total time for perm injection was 17 minutes.
- Approximately 40 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were recorded during this injection.

7.2 E-9 Injection Event (Water Level Measurements)

Injection Zone (30-40 ft.) Injection: Injection Rate 8 gpm @ 25 psi well pressure, injection volume 136 gallons.

Significant Hydraulic Connection: E-9 to E-10 with 2.16 ft. water level increase at E-10.

Good Hydraulic Connection: E-9 to E-11 with 1.18 ft. water level increase at E-11.

Limited Hydraulic Connection: E-9 to E-6 with 0.16 ft. water level increase at E-6; E-9 to E-5 with 0.14 ft. water level increase at E-5; and E-9 to MW-13S with 0.08 ft. water level increase at MW-13S.

No hydraulic connection between E-9 and E-3.

8.0 WELL E-1

8.1 Well E-1 (Lower Zone - 60' to 80' Interval)

- Total perm injected to interval was 350 gallons on December 4, 2014.
- Average pressure during injection was 60 psi.
- Average flow rate during injection was 6.7 gpm.

- Total time for perm injection was 52 minutes.
- 35 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were reported during this injection.

8.2 Well E-1 (Upper Zone - 20' to 40' Interval)

- Total perm injected to interval was 360 gallons on December 4, 2014.
- Average pressure during injection was 0.0 psi.
- Average flow rate during injection was 7.8 gpm.
- Total time for perm injection was 46 minutes.
- 55 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were reported during this injection.

8.3 E-1 Injection Event (Water Level Measurements)

A. Lower Zone (60-80 ft.): Injection Rate 6.7 gpm @ 60-psi well pressure.

Significant Hydraulic Connection: E-1 to MW-10B with 4.13 ft. water level increase at MW-10B.
Good Hydraulic Connection: E-1 to MW-15I with 2.41 ft. water level increase at MW-15I.

Limited or No Hydraulic Connection: E-1 to MW-10C with 0.97 ft. water level increase at MW-10C; E-1 to MW-28S with 0.45 ft. water level increase at MW-28S; E-1 to MW-28I with 0.43 ft. water level increase at MW-28I; and E-1 to MW-15S with 0.14 ft. water level increase at MW-15S.

B. Shallow Zone (20-40 ft.): Injection Rate 7.8 gpm @ 0-psi well pressure.

Significant Hydraulic Connection: E-1 to MW-10A with 3.42 ft. water level increase at MW-10A.

Good Hydraulic Connection: E-1 to MW-28S with 1.75 ft. water level increase at MW-28S.

Limited or No Hydraulic Connection: E-1 to MW-10B with 0.79 ft. water level increase at MW-10B; E-1 to MW-10C with 0.06 ft. water level increase at MW-10C; E-1 to MW-28I with 0.78 ft. water level increase at MW-28I; E-1 to MW-15S with 0.19 ft. water level increase at MW-15S; and E-1 to MW-15I with 0.36 ft. water level increase at MW-15I.

9.0 WELL MW-10A

9.1 Well MW-10A (36' to 46' Screened Interval)

- Total perm injected to interval was 145 gallons on December 4, 2014.
- Average pressure during injection was 45 psi.
- Average flow rate during injection was 2.7 gpm.
- Total time for perm injection was 52 minutes.
- 25 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were reported during this injection.

9.2 MW-10A Injection Event (Water Level Measurements)

Injection Zone (36-46 ft.): Injection Rate 2.9 gpm @ 45-psi well pressure.

Significant Hydraulic Connection: MW-10A to MW-10B with 1.16 ft. water level increase at MW-10B.

Good Hydraulic Connection: MW-10A to E-1 with 0.66 ft. water level increase at E-1.

Limited Hydraulic Connection: MW-10A to MW-10C with 0.24 ft. water level increase at MW-10C; and MW-10A to MW-28S with 0.30 ft. water level increase at MW-28S.

No hydraulic connection from MW-10A to E-7 and to MW-15S.

10.0 WELL E-3

10.1 Well E-3 (Single Zone - 40' to 60' Interval)

- Total perm injected to interval was 350 gallons on December 4, 2014.
- Average pressure during injection was 30 psi.
- Average flow rate during injection was 10.2 gpm.
- Total time for perm injection was 34 minutes.
- 40 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were recorded during this injection.

10.2 E-3 Injection Event (Water Level Measurements)

Injection Zone (40-60 ft): Injection Rate 10.2 gpm @ 30-psi well pressure.

Significant Hydraulic Connection: E-3 to MW-12S with 13.39 ft. water level increase at MW-12S.

Good Hydraulic Connection: E-3 to MW-12I with 1.05 ft. water level increase at MW-12I.

Limited Hydraulic Connection: E-3 to MW-18S with 0.42 ft. water level increase at MW-18S.

No hydraulic connection from E-3 to E-6 and to E-10.

11.0 WELL E-2

11.1 Well E-2 (Single Zone - 32' to 52' Interval)

- Total perm injected to interval was 350 gallons on December 5, 2014.
- Average pressure during injection was 30 psi.
- Average flow rate during injection was 10.2 gpm.
- Total time for perm injection was 34 minutes.
- Potable water was not flushed/injected to well following perm injection.

The total proposed amount of perm was injected to this well; however, due to daylighting of perm at well E-14 at the very end of the injection, activities were stopped prior to completing the water flush of pumps/lines for this zone. All spillage to ground surface caused by daylighting was neutralized and cleaned up by site personnel.

11.2 E-2 Injection Event (Water Level Measurements)

Injection Zone (32-52 ft.): Injection Rate 10.2 gpm @ 30-psi well pressure.

Significant Hydraulic Connection: E-2 to E-14 with 5.97 ft. water level increase at E-14.

Good Hydraulic Connection: E-2 to MW-11S with 1.08 ft. water level increase at MW-11S.

Limited Hydraulic Connection: E-2 to MW-11D with 0.51 ft. water level increase at MW-11D; and E-2 to MW-31S with 0.13 ft. water level increase at MW-31S.

No hydraulic connection from E-2 to E-7, E-8, and to MW-28S.

12.0 WELL MW-11S

12.1 Well MW-11S (44' to 54' Screened Interval)

- Total perm injected to interval was 140 gallons on December 5, 2014.
- Average pressure during injection was 35 psi.
- Average flow rate during injection was 1.6 gpm.
- Total time for perm injection was 86 minutes.
- 15 gallons of potable water were flushed/injected to well following perm injection.

No problems or issues were noted during this injection.

12.2 MW-11S Injection Event (Water Level Measurements)

Injection Zone (44-54 ft.): Injection Rate 1.6 gpm @ 35-psi well pressure.

Significant Hydraulic Connection: MW-11S to MW-11D with 2.35 ft. water level increase at MW-11D.

Limited Hydraulic Connection: MW-11S to E-8 with 0.16 ft. water level increase at E-8; and MW-11S to MW-31I with 0.49 ft. water level increase at MW-31I.

No hydraulic connection from MW-11S to MW-31S and to MW-28S.

13.0 WELL MW-13I

13.1 Well MW-13I (78' to 88' Screened Interval)

- Total perm injected to interval was 225 gallons on December 8, 2014.
- Average pressure during injection was 20 psi.
- Average flow rate during injection was 7.0 gpm.
- Total time for perm injection was 32 minutes.
- 15 gallons of potable water were flushed/injected to well following perm injection.

Subcontractor personnel emptied the 5,000-gallon perm tank to the transfer tank for completion of injections at well cluster MW-13. A total of 450 gallons of perm remained when transfer activities were completed. This remaining volume was divided equally between the two MW-13 wells. No problems or issues were noted.

13.2 MW-13I Injection Event (Water Level Measurements)

Injection Zone (78-88 ft.): Injection Rate 7 gpm @ 20-psi well pressure.

Limited Hydraulic Connection: MW-13I to E-9 with 0.09 ft. water level increase at E-9; MW-13I to E-10 with 0.09 ft. water level increase at E-10; MW-13I to MW-2S with 0.15 ft. water level increase at MW-2S; MW-13I to MW-2I with 0.07 ft. water level increase at MW-2I; MW-13I to E-5 with 0.05 ft. water level increase at E-5.

No hydraulic connection from MW-13I to MW-13S.

14.0 WELL MW-13S

14.1 Well MW-13S (20' to 35' Screened Interval)

- Total perm injected to interval was 225 gallons on December 8, 2014.
- Average pressure during injection was 10 psi.
- Average flow rate during injection was 9.0 gpm.
- Total time for perm injection was 25 minutes.
- 40 gallons of potable water were flushed/injected to well following perm injection.

Subcontractor personnel emptied the 5,000-gallon perm tank to the transfer tank for completion of injections at well cluster MW-13. A total of 450 gallons of perm remained when transfer activities were completed. This remaining volume was divided equally between the two MW-13 cluster wells. No problems or issues were reported for at this location.

14.2 MW-13S Injection Event (Water Level Measurements)

Injection Zone (20-35 ft.): Injection Rate 7.9 gpm @ 10-psi well pressure.

Limited or No Hydraulic Connection: MW-13S to E-9 with 0.08 ft. water level increase at E-9; MW-13S to E-10 with 0.11 ft. water level increase at E-10; MW-13I to MW-2S with 0.05 ft. water level increase at MW-2S; MW-13I to MW-2I with 0.04 ft. water level increase at MW-2I; and MW-13I to E-5 with 0.05 ft. water level increase at E-5.

15.0 WELL E-7

15.1 Well E-7 (Entire Zone - 20' to 150' Interval)

- Total perm gravity fed to interval was 60 gallons on December 8, 2014.
- Average pressure during injection was 0.0 psi.
- Average flow rate during injection was 2.0 gpm.
- Total time for perm injection was 30 minutes.

Subcontractor and Tetra Tech personnel flushed out the 5,000-gallon perm tank with potable water. A total of approximately 60 gallons of a dilute perm solution were generated and pumped to the transfer tank for injecting into well E-7. The solution was gravity fed to well by placing transfer tank adjacent to well and installing a section of transfer hose from tank to well. No problems or issues were reported during the activities at this location.

Water levels were not recorded during well E-7 injection work.

16.0 SUMMARY

Based on the above injection summaries, a total of 9,131 gallons of permanganate was injected to 19 total zones at the site (does not include dilute solution placed into E-7).

At the completion of injection activities, all subcontractor equipment was neutralized and power washed in the portable decon/containment pad. The interior of the 5,000-gallon tank was power washed and the diluted perm solution generated was placed into well E-7 as noted above.

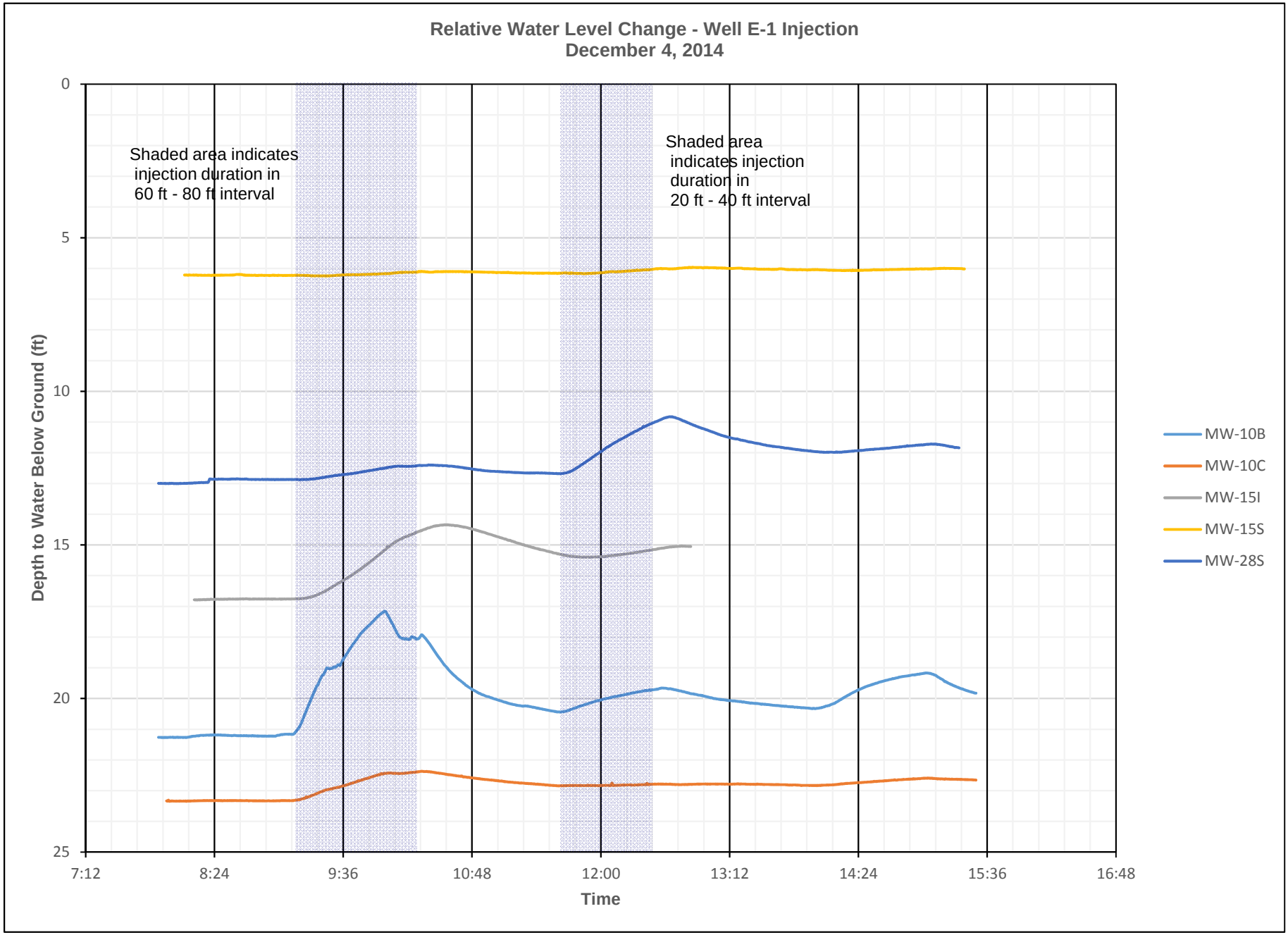
The temporary containment pad under the 5,000-gallon tank and the exterior of the tank were cleaned. The majority of the containment pad under the tank was dismantled. A portion of the containment pad under the 5,000-gallon tank could not be cleaned or removed. This material will need to be cleaned when the tank is removed from the site. All permanganate contained within the pad was neutralized and all material generated by cleaning and decon procedures was placed into 55-gallon drums.

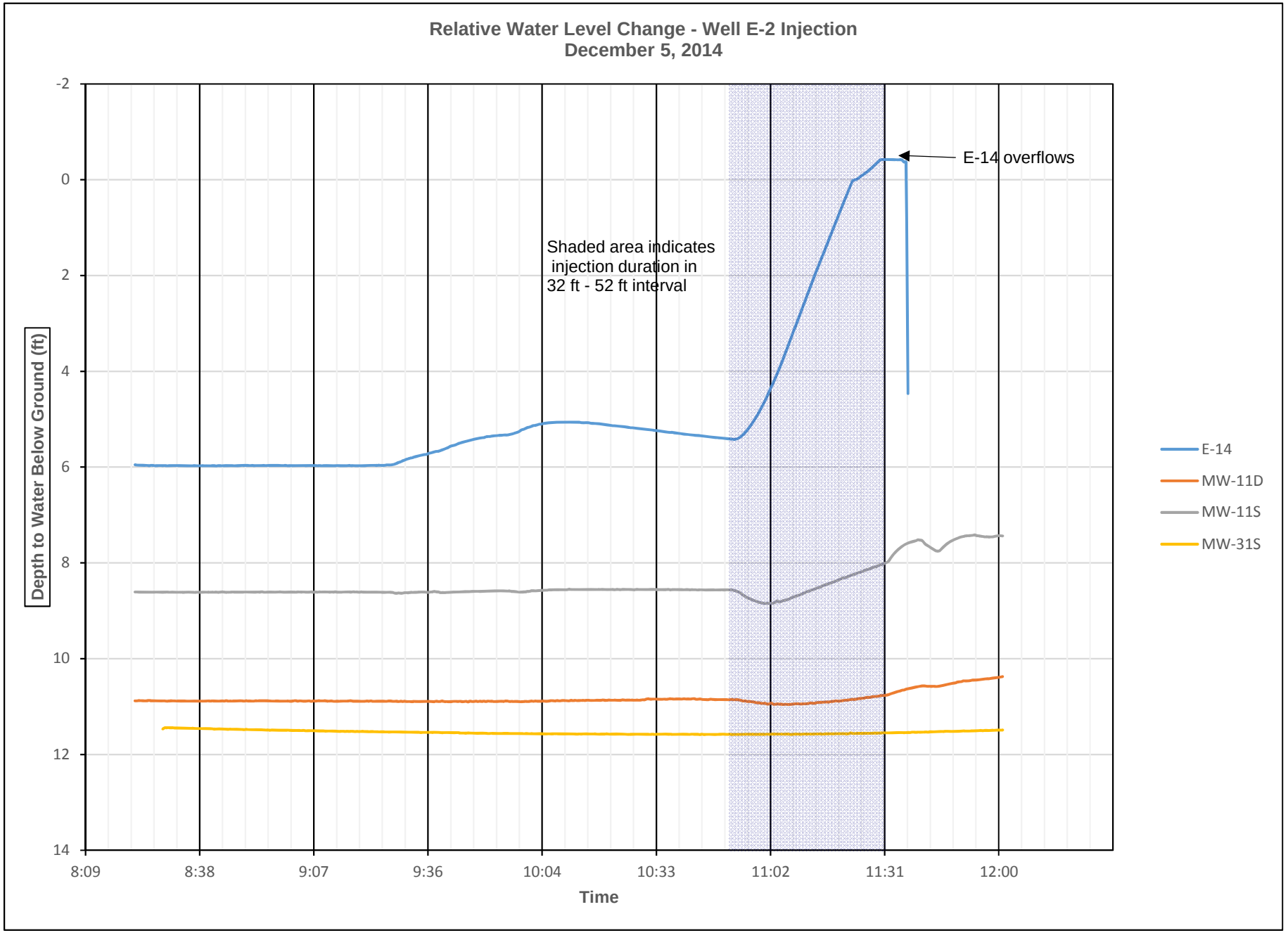
Five drums of IDW were generated. The drums were placed onto pallets, labeled, and staged at the rear of the site building near well E-2.

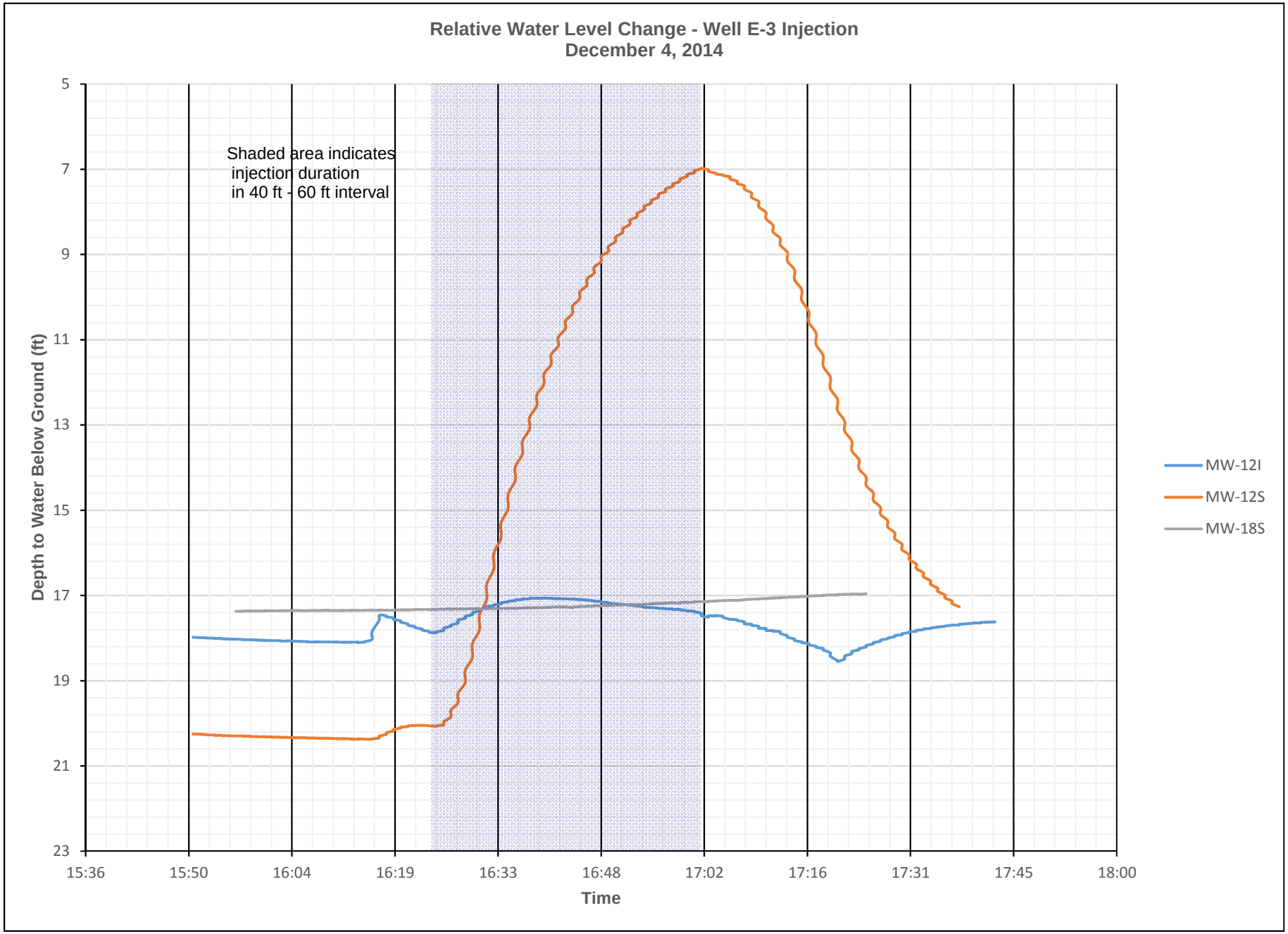
Tetra Tech completed a recon of the site and all injection locations and no problems or issues were noted.

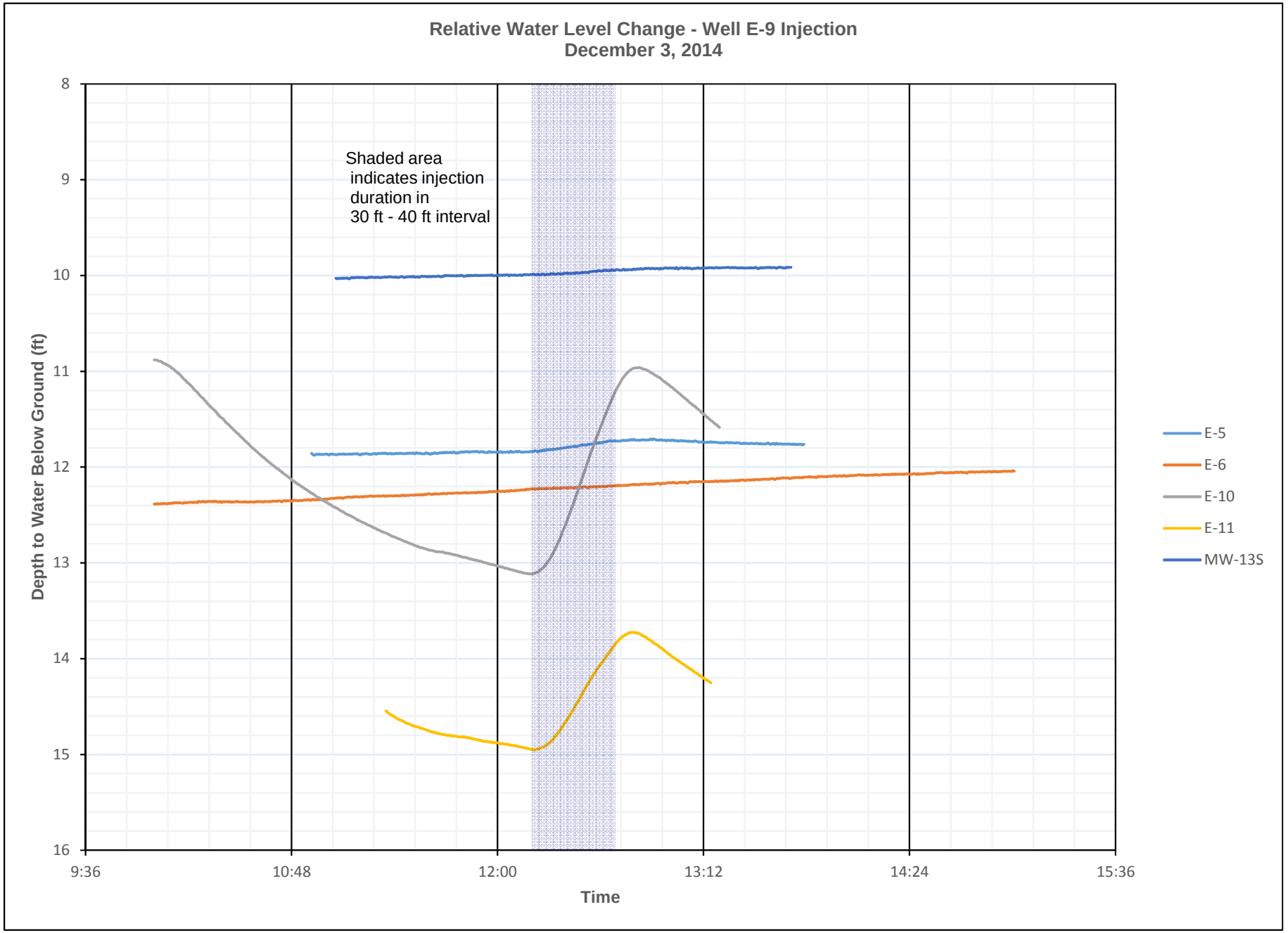
ATTACHMENT

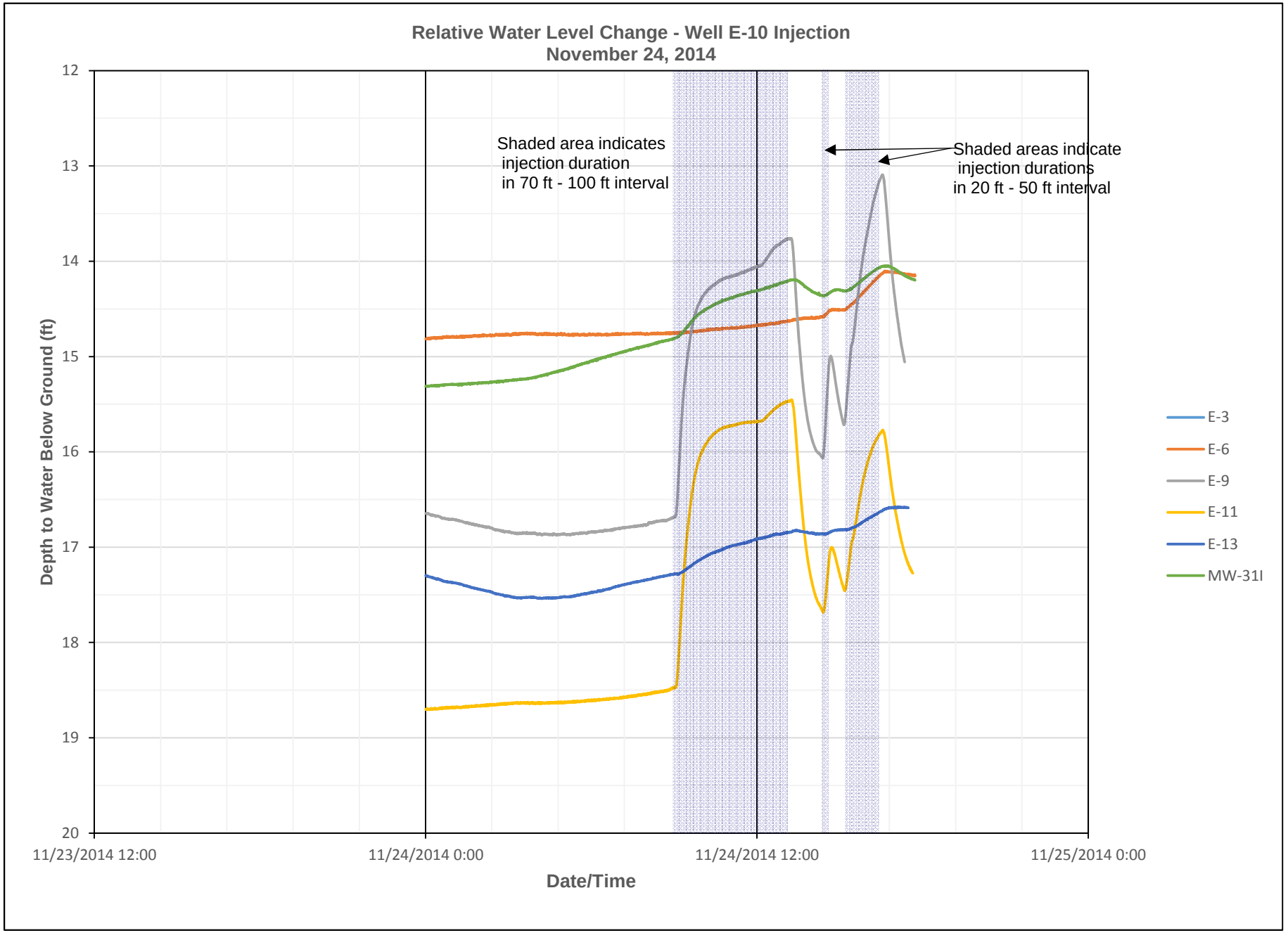
PRESSURE TRANSDUCER MEASUREMENT GRAPHS

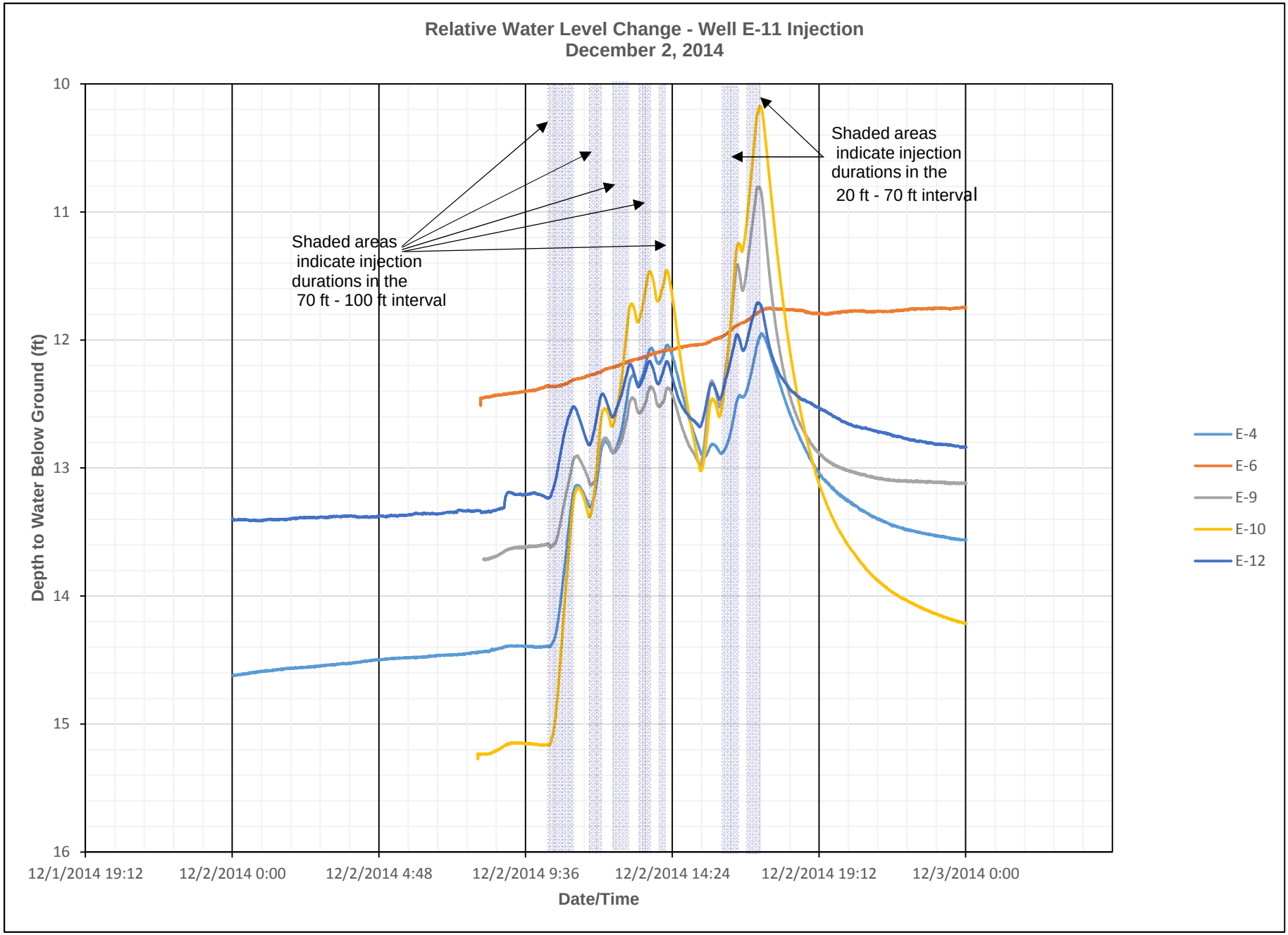

Relative Water Level Change - Well E-1 Injection
December 4, 2014
Shaded area indicates injection duration in 60 ft - 80 ft interval
Shaded area indicates injection duration in 20 ft - 40 ft interval
Depth to Water Below Ground (ft)
0
5
10
15
20
25
7:12
8:24
9:36
10:48
12:00
13:12
14:24
15:36
16:48
Time
MW-10B
MW-10C
MW-15I
MW-15S
MW-28S

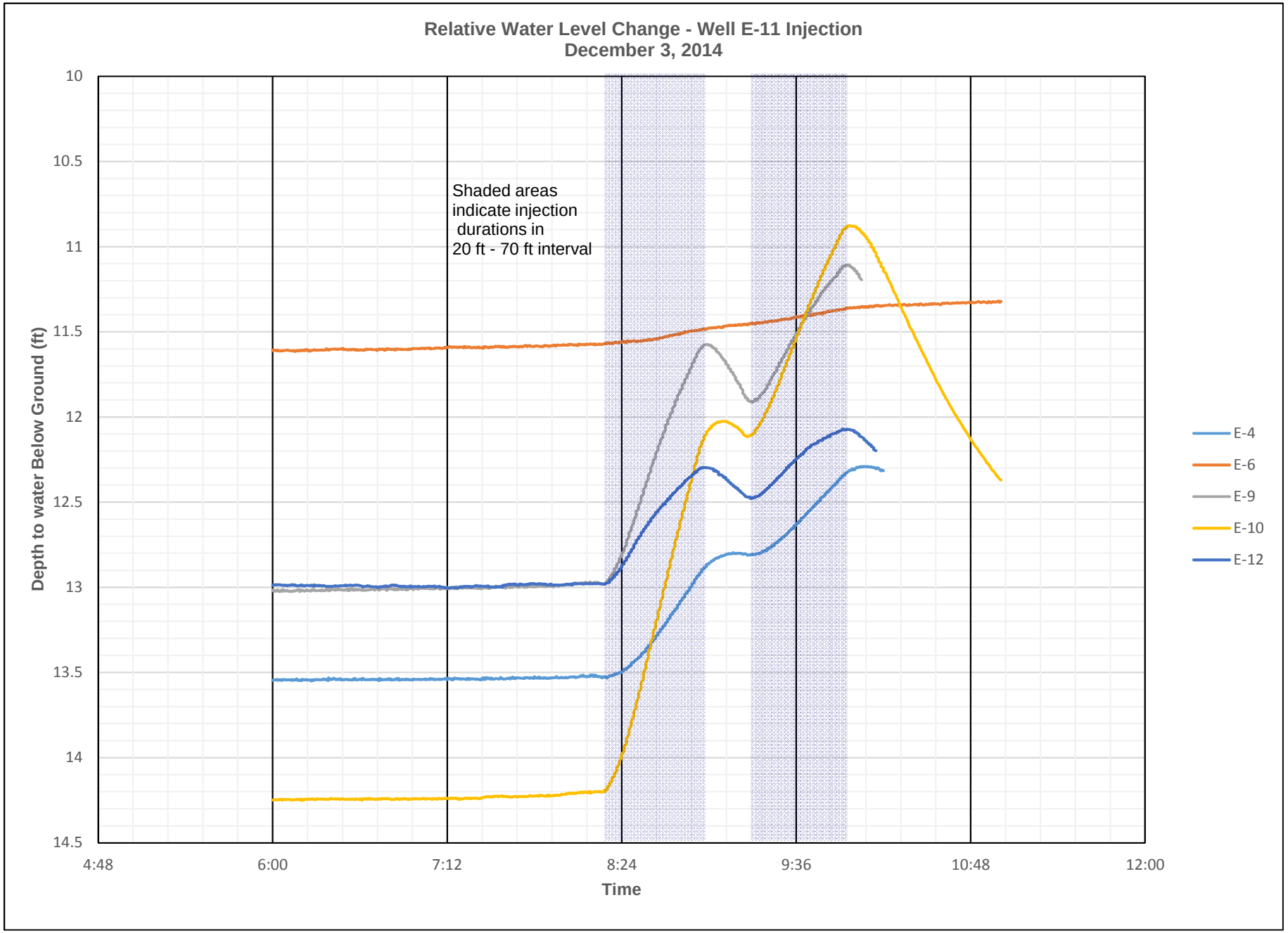

Relative Water Level Change - Well E-2 Injection
December 5, 2014
Depth to Water Below Ground (ft)
-2
0
2
4
6
8
10
12
14
8:09
8:38
9:07
9:36
10:04
10:33
11:02
11:31
12:00
Time
E-14 overflows
Shaded area indicates
injection duration in
32 ft - 52 ft interval
E-14
MW-11D
MW-11S
MW-31S

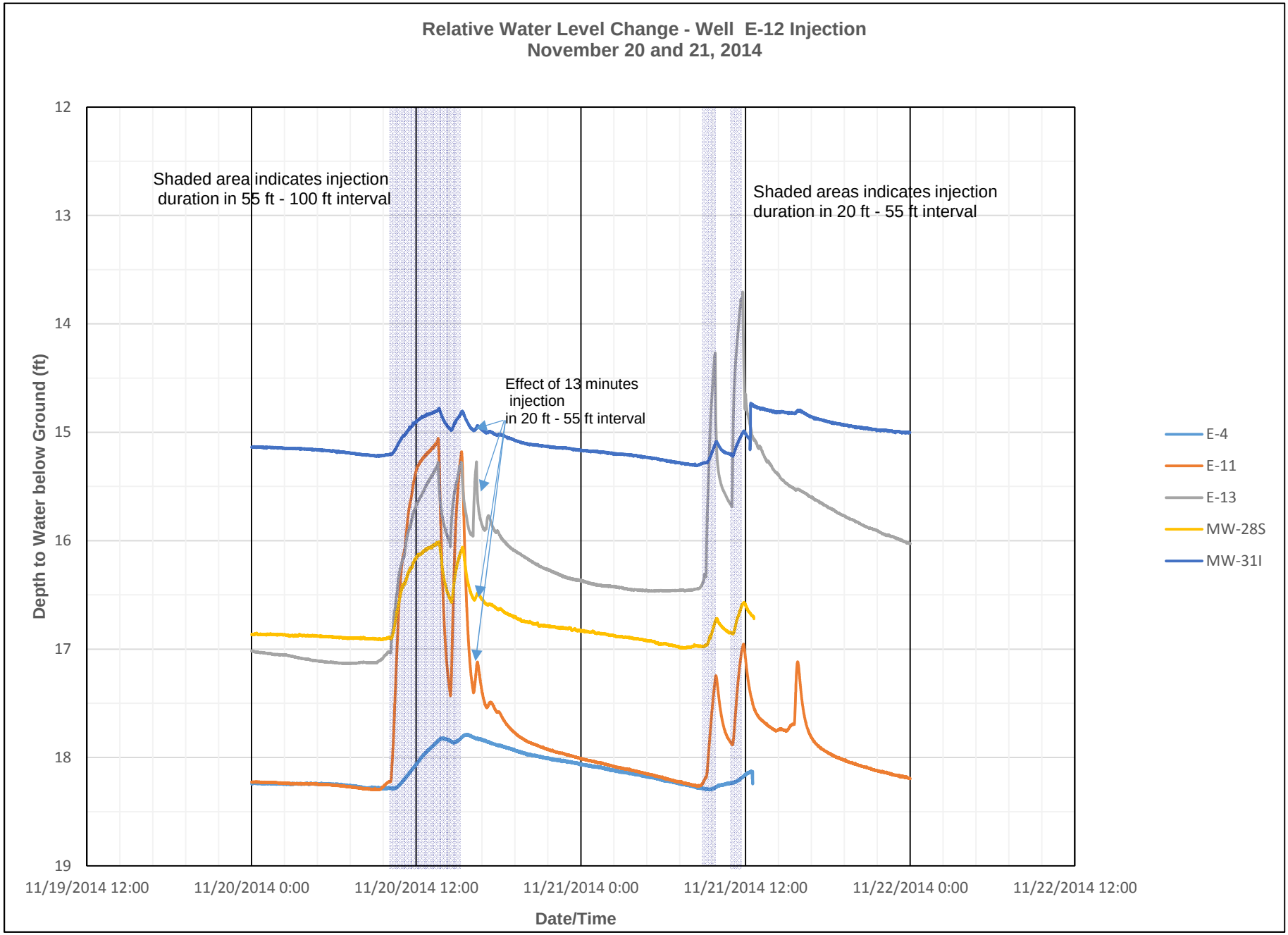

Relative Water Level Change - Well E-3 Injection
December 4, 2014
Shaded area indicates
injection duration
in 40 ft - 60 ft interval
Depth to Water Below Ground (ft)
5
7
9
11
13
15
17
19
21
23
15:36
15:50
16:04
16:19
16:33
16:48
17:02
17:16
17:31
17:45
18:00
Time
MW-12I
MW-12S
MW-18S

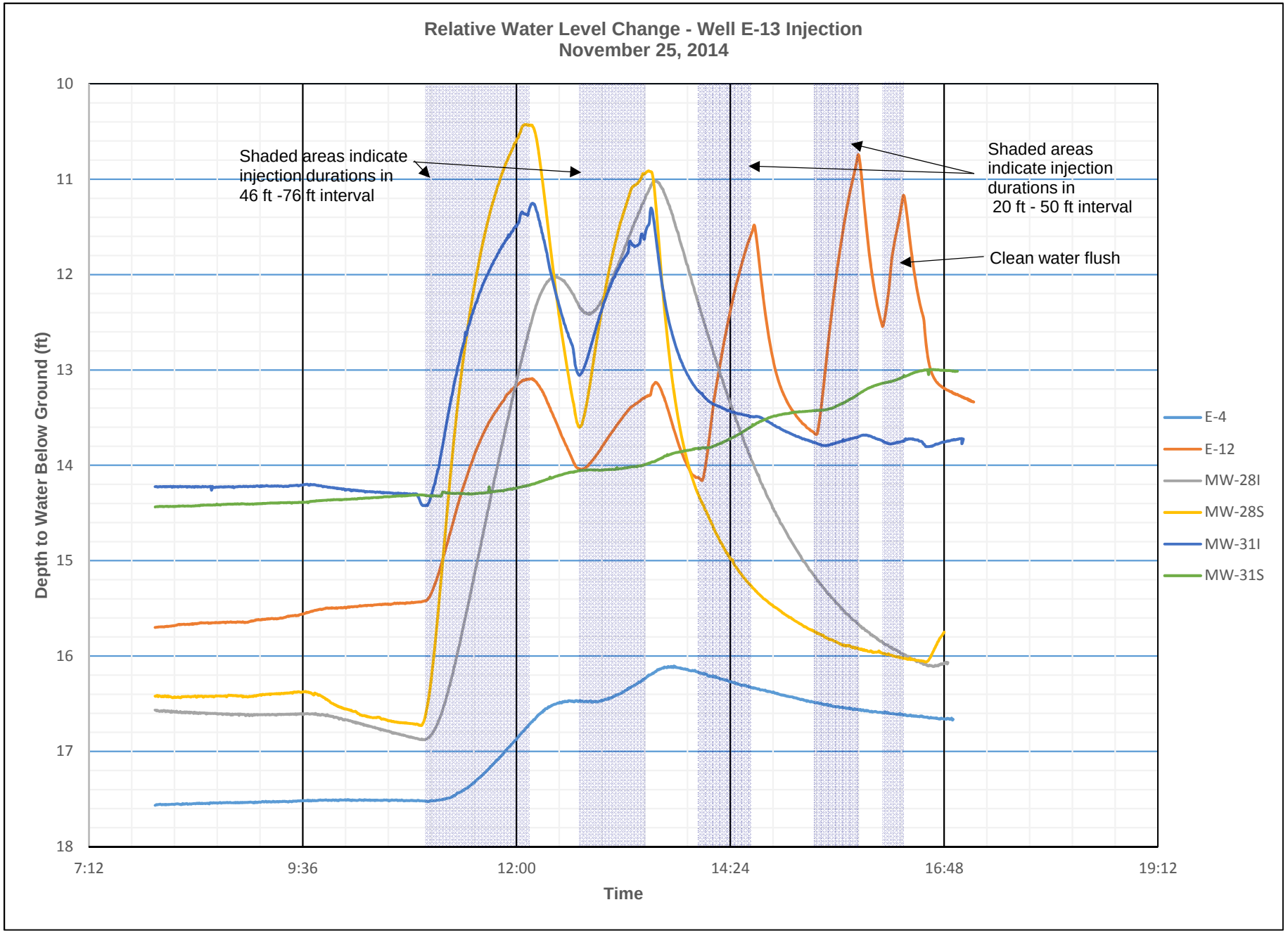

Relative Water Level Change - Well E-9 Injection
December 3, 2014
Shaded area
indicates injection
duration in
30 ft - 40 ft interval
Depth to Water Below Ground (ft)
8
9
10
11
12
13
14
15
16
9:36
10:48
12:00
13:12
14:24
15:36
Time
E-5
E-6
E-10
E-11
MW-13S

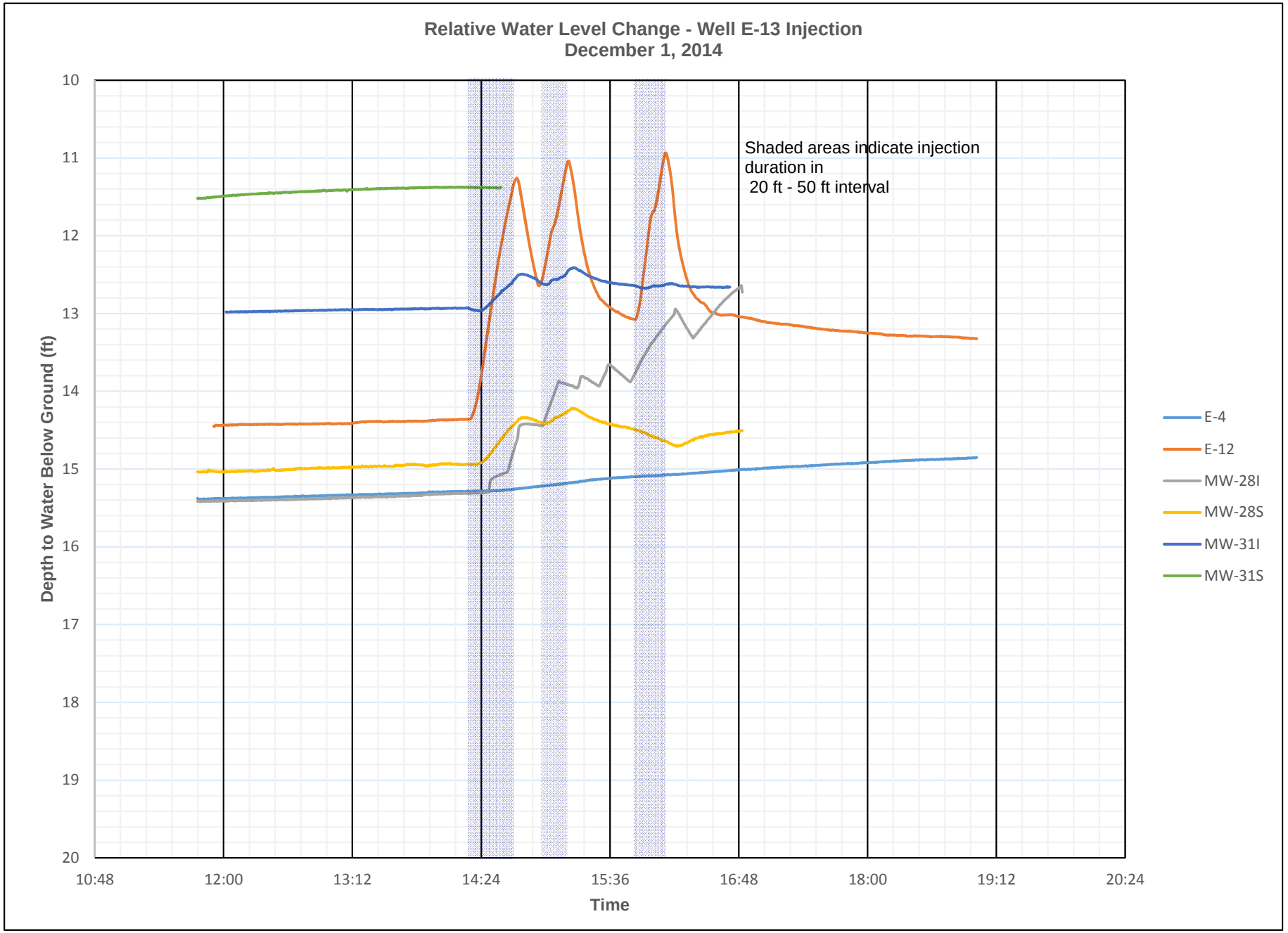

Relative Water Level Change - Well E-10 Injection
November 24, 2014
Shaded area indicates injection duration in 70 ft - 100 ft interval
Shaded areas indicate injection durations in 20 ft - 50 ft interval
Depth to Water Below Ground (ft)
12
13
14
15
16
17
18
19
20
11/23/2014 12:00
11/24/2014 0:00
11/24/2014 12:00
11/25/2014 0:00
Date/Time
E-3
E-6
E-9
E-11
E-13
MW-31I

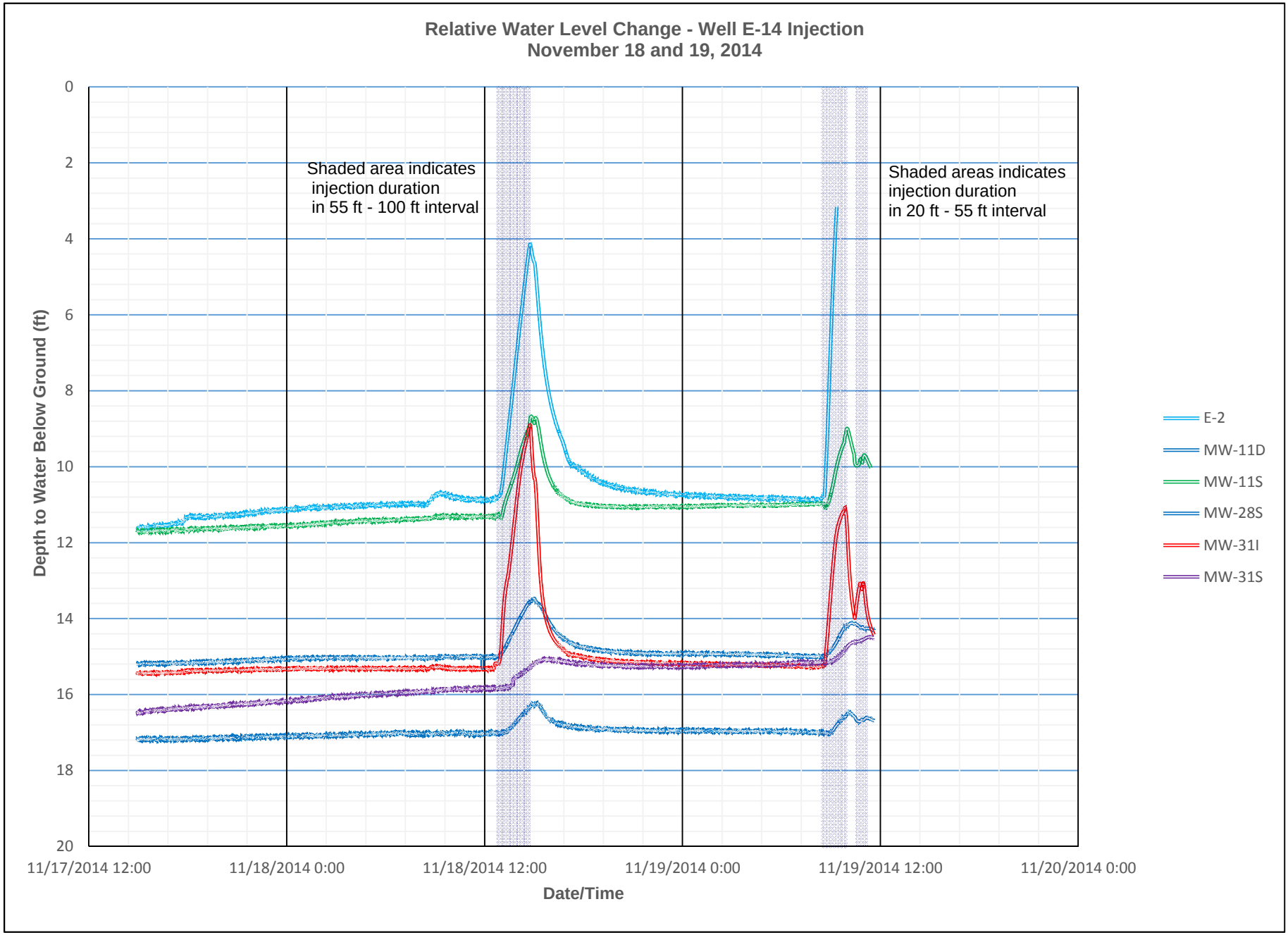

Relative Water Level Change - Well E-11 Injection
December 2, 2014
Shaded areas indicate injection durations in the 70 ft - 100 ft interval
Shaded areas indicate injection durations in the 20 ft - 70 ft interval
Depth to Water Below Ground (ft)
10
11
12
13
14
15
16
12/1/2014 19:12
12/2/2014 0:00
12/2/2014 4:48
12/2/2014 9:36
12/2/2014 14:24
12/2/2014 19:12
12/3/2014 0:00
Date/Time
E-4
E-6
E-9
E-10
E-12

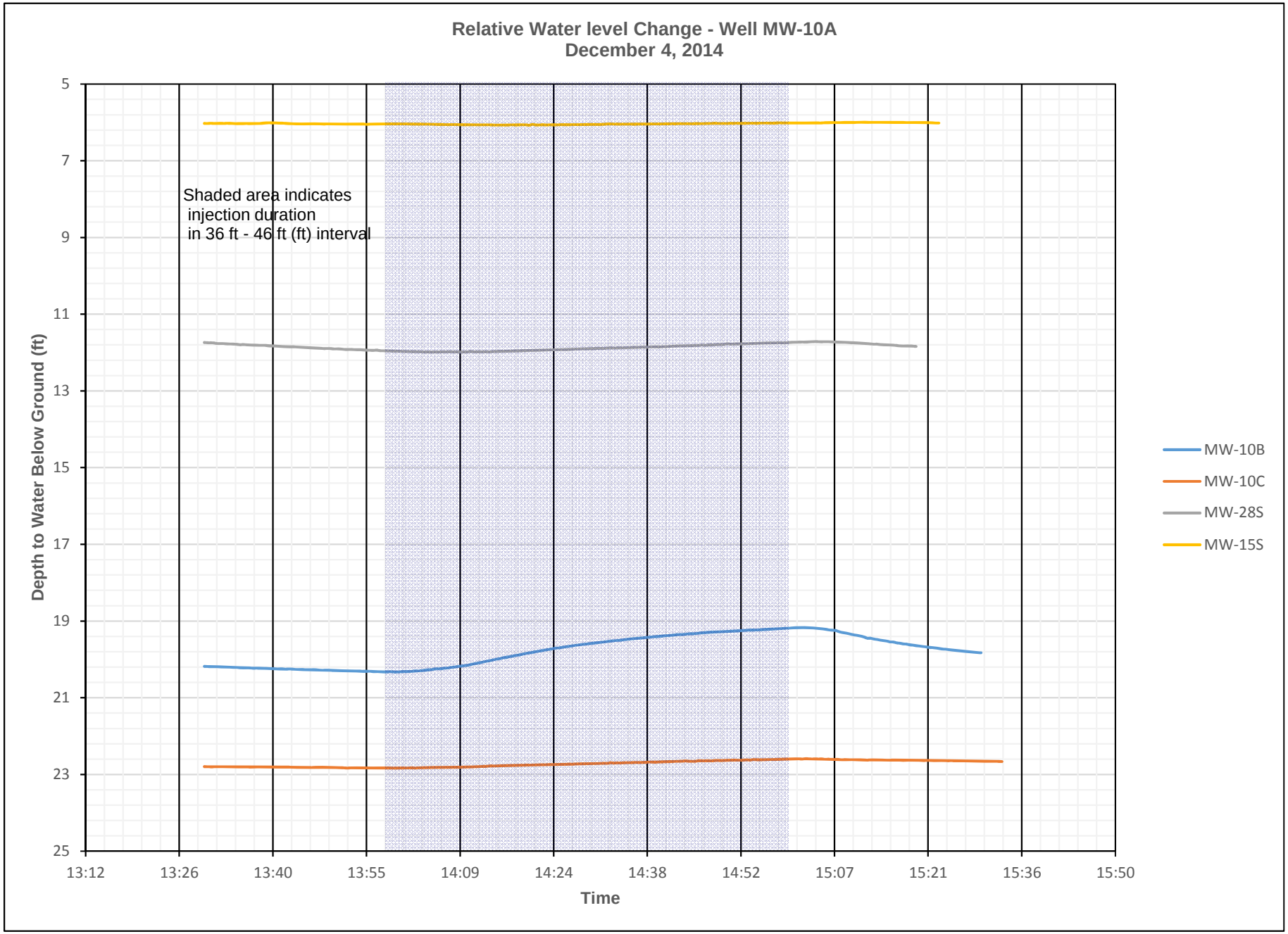

Relative Water Level Change - Well E-11 Injection
December 3, 2014
Shaded areas
indicate injection
durations in
20 ft - 70 ft interval
Depth to water Below Ground (ft)
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
4:48
6:00
7:12
8:24
9:36
10:48
12:00
Time
E-4
E-6
E-9
E-10
E-12

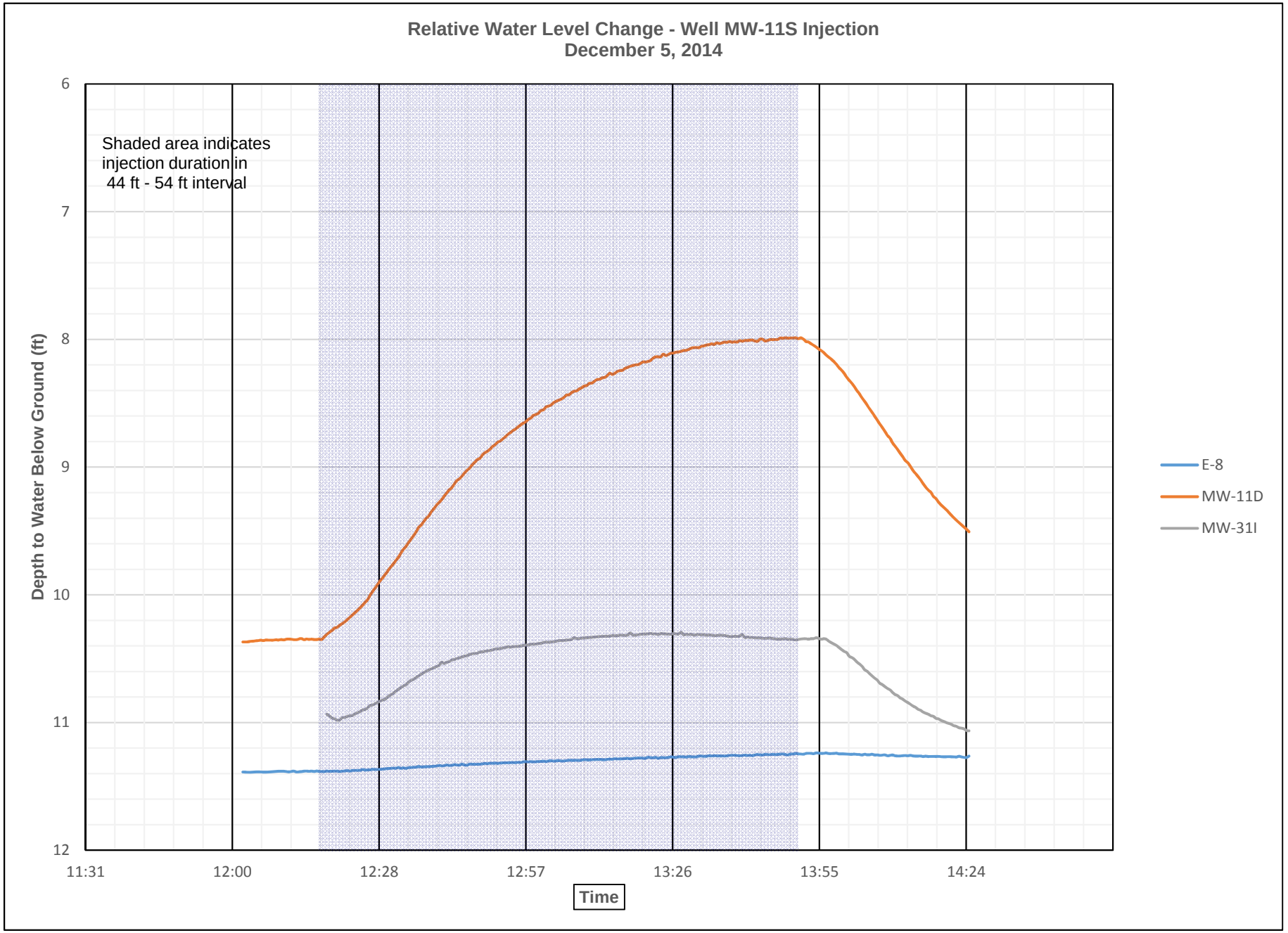

Relative Water Level Change - Well E-12 Injection
November 20 and 21, 2014
Shaded area indicates injection duration in 55 ft - 100 ft interval
Shaded areas indicates injection duration in 20 ft - 55 ft interval
Effect of 13 minutes injection in 20 ft - 55 ft interval
Depth to Water below Ground (ft)
12
13
14
15
16
17
18
19
11/19/2014 12:00
11/20/2014 0:00
11/20/2014 12:00
11/21/2014 0:00
11/21/2014 12:00
11/22/2014 0:00
11/22/2014 12:00
Date/Time
E-4
E-11
E-13
MW-28S
MW-31I

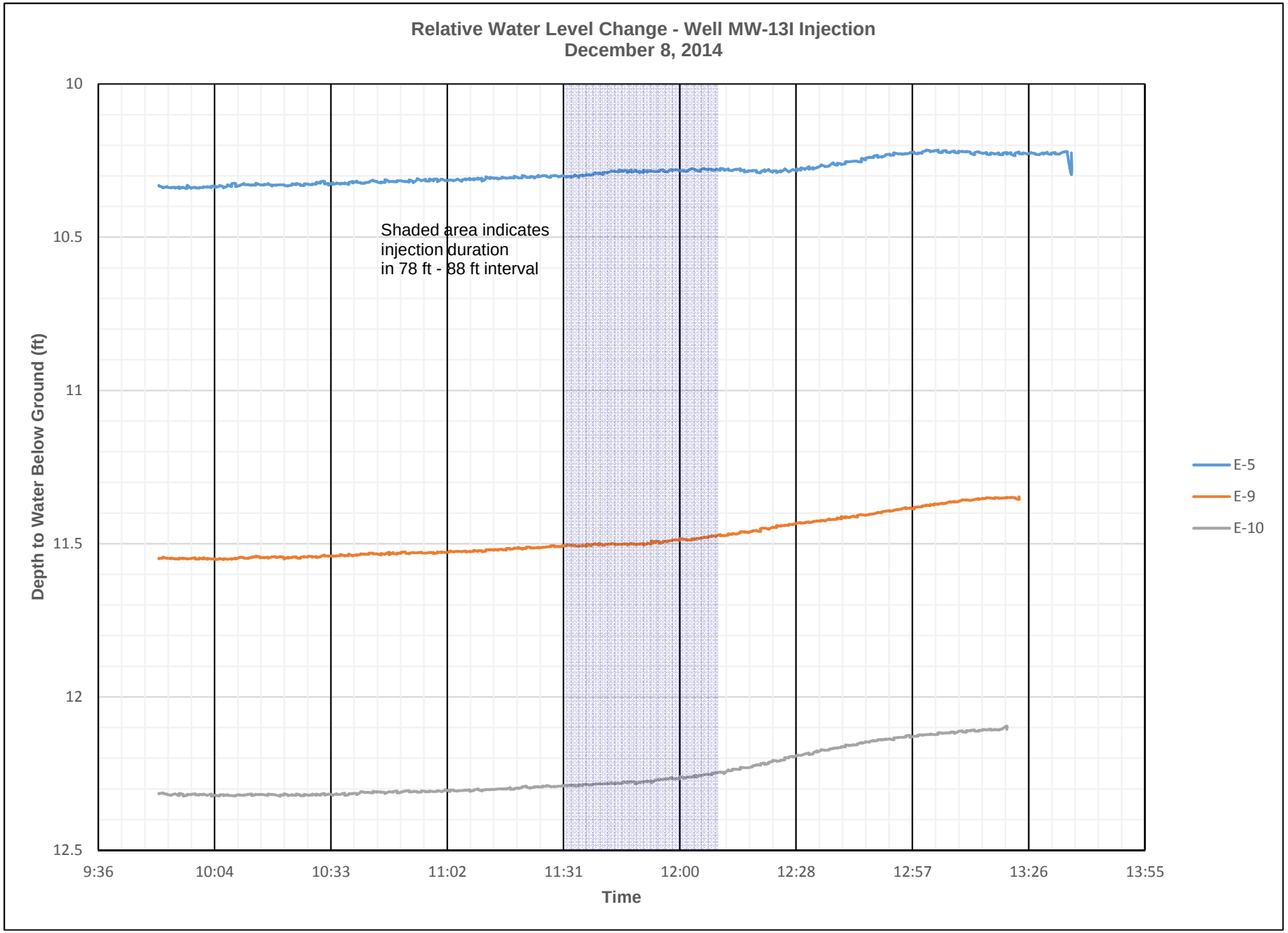

Relative Water Level Change - Well E-13 Injection
November 25, 2014
Shaded areas indicate injection durations in 46 ft -76 ft interval
Shaded areas indicate injection durations in 20 ft - 50 ft interval
Clean water flush
Depth to Water Below Ground (ft)
10
11
12
13
14
15
16
17
18
7:12
9:36
12:00
14:24
16:48
19:12
Time
E-4
E-12
MW-28I
MW-28S
MW-31I
MW-31S

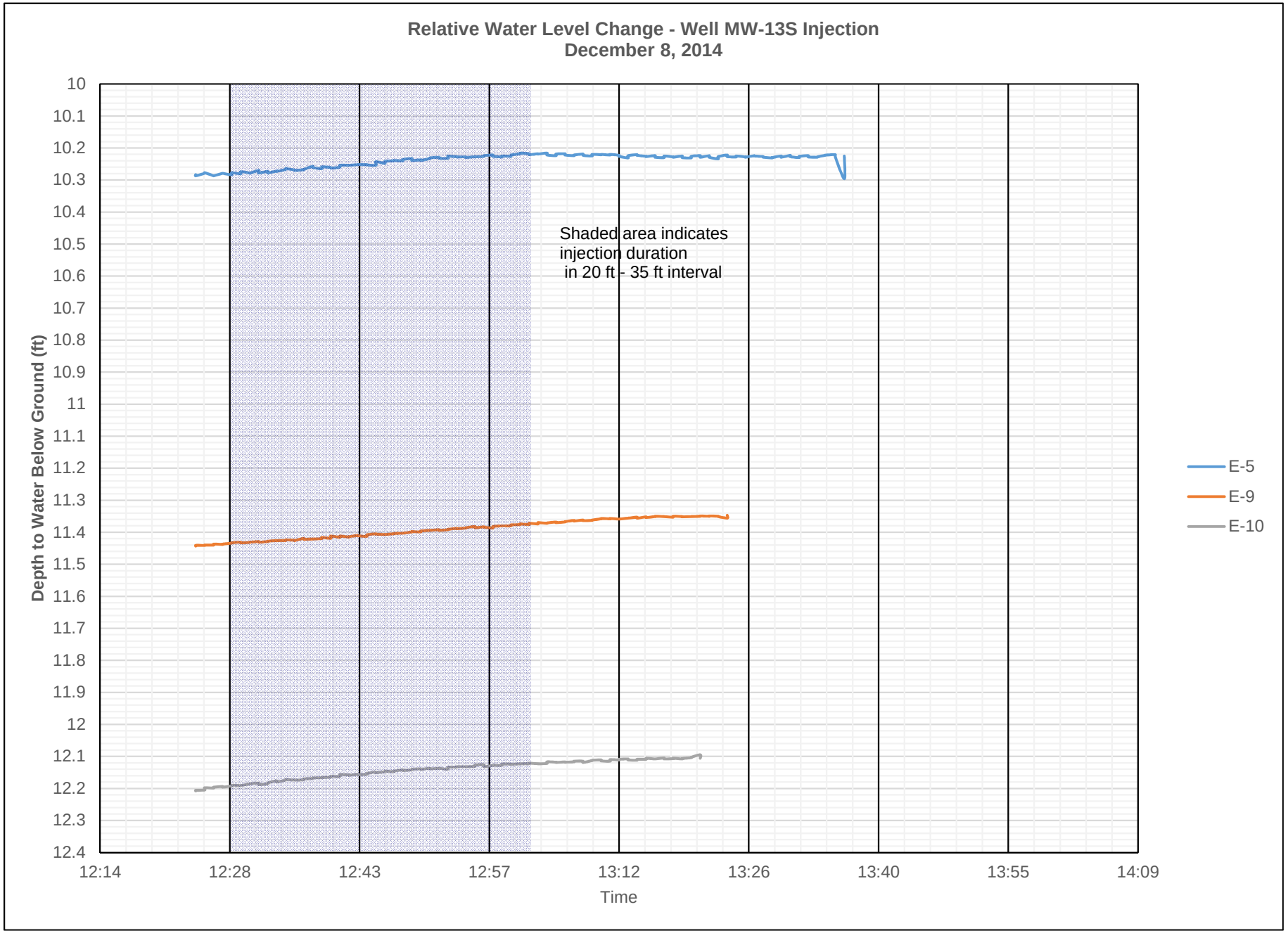

Relative Water Level Change - Well E-13 Injection
December 1, 2014
Shaded areas indicate injection duration in
20 ft - 50 ft interval
Depth to Water Below Ground (ft)
10
11
12
13
14
15
16
17
18
19
20
10:48
12:00
13:12
14:24
15:36
16:48
18:00
19:12
20:24
Time
E-4
E-12
MW-28I
MW-28S
MW-31I
MW-31S


Relative Water Level Change - Well E-14 Injection
November 18 and 19, 2014
Shaded area indicates injection duration in 55 ft - 100 ft interval
Shaded areas indicates injection duration in 20 ft - 55 ft interval
Depth to Water Below Ground (ft)
0
2
4
6
8
10
12
14
16
18
20
11/17/2014 12:00
11/18/2014 0:00
11/18/2014 12:00
11/19/2014 0:00
11/19/2014 12:00
11/20/2014 0:00
Date/Time
E-2
MW-11D
MW-11S
MW-28S
MW-31I
MW-31S


Relative Water level Change - Well MW-10A
December 4, 2014
Shaded area indicates
injection duration
in 36 ft - 46 ft (ft) interval
Depth to Water Below Ground (ft)
5
7
9
11
13
15
17
19
21
23
25
13:12
13:26
13:40
13:55
14:09
14:24
14:38
14:52
15:07
15:21
15:36
15:50
Time
MW-10B
MW-10C
MW-28S
MW-15S


Relative Water Level Change - Well MW-11S Injection
December 5, 2014
Shaded area indicates injection duration in 44 ft - 54 ft interval
Depth to Water Below Ground (ft)
6
7
8
9
10
11
12
11:31
12:00
12:28
12:57
13:26
13:55
14:24
Time
E-8
MW-11D
MW-31I


Relative Water Level Change - Well MW-13I Injection
December 8, 2014
Shaded area indicates
injection duration
in 78 ft - 88 ft interval
Depth to Water Below Ground (ft)
10
10.5
11
11.5
12
12.5
9:36
10:04
10:33
11:02
11:31
12:00
12:28
12:57
13:26
13:55
Time
E-5
E-9
E-10


Relative Water Level Change - Well MW-13S Injection
December 8, 2014
Depth to Water Below Ground (ft)
10
10.1
10.2
10.3
10.4
10.5
10.6
10.7
10.8
10.9
11
11.1
11.2
11.3
11.4
11.5
11.6
11.7
11.8
11.9
12
12.1
12.2
12.3
12.4
12:14
12:28
12:43
12:57
13:12
13:26
13:40
13:55
14:09
Time
Shaded area indicates
injection duration
in 20 ft - 35 ft interval
E-5
E-9
E-10